

Claims

What is claimed is:

1. A mechanism for selectively controlling the movement of a linearly-displaceable member relative to a frame, comprising:

5 a motor mounted on one of said member and frame, and having a rotatable output shaft;

a first mechanical transmission having a screw with an axial force reaction bearing mounted on one of said member and frame, and having a nut mounted on the other of said member and frame, said nut being in mating engagement with said screw;

10 said motor shaft being arranged to rotate one of said screw and nut with respect to the other of said screw and nut so as to displace said member with respect to said frame;

a hydrostatic second transmission having first and second pistons, said first piston being arranged in series between said axial force reaction bearing and said screw, said
15 first piston being operatively arranged to generate pressure as a function of the axial force reacted through said first mechanical transmission, said second piston being arranged to produce a pressure-induced force between said frame and member;

a transfer mechanism operatively arranged to either (a) lock said first piston relative to one of said frame and member and to allow free motion of said second piston
20 relative to the other of said frame and member, or (b) transfer fluid from said first piston to said second piston;

whereby said motor output shaft may be selectively coupled to said member either through said first transmission to impart a high-speed low-force drive to said member, or through said second transmission to impart a low-speed high-force drive to said mem-
25 ber.

2. A mechanism as set forth in claim 1 wherein said first piston is mounted for sealed sliding movement within a first cylinder.

3. A mechanism as set forth in claim 2 wherein said first piston is mounted for axial and rotative movement relative to said first cylinder.
4. A mechanism as set forth in claim 3 wherein said first piston and said first cylinder act as said axial force reaction bearing.
- 5 5. A mechanism as set forth in claim 2 wherein said second piston is mounted for sealed sliding movement within a second cylinder.
6. A mechanism as set forth in claim 1, and further comprising:
an engaging device for selectively coupling said second transmission mechanism to said output member at any position of said output member.
- 10 7. A mechanism for selectively controlling the movement of a linearly-displaceable member in two directions relative to a frame, comprising:
a motor mounted on one of said member and frame, and having a rotatable output shaft;
a first mechanical transmission having a screw with an axial force reaction bearing mounted on one of said member and frame, and having a nut mounted on the other of said member and frame, said nut being in mating engagement with said screw;
said motor shaft being arranged to rotate one of said screw and nut with respect to the other of said screw and nut so as to displace said member with respect to said frame;
- 20 a hydrostatic second transmission having first and second pistons, said first piston being operatively arranged to generate pressure as a function of the axial force reacted through said first mechanical transmission, said second piston being arranged to produce a pressure-induced force between said frame and member;
a transfer mechanism operatively arranged to either (a) lock said first piston relative to one of said frame and member and to allow free motion of said second piston relative to the other of said frame and member, or (b) transfer fluid from said first piston to said second piston;
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whereby said motor output shaft may be selectively coupled to said member either through said first transmission to impart a high-speed low-force drive to said member, or through said second transmission to impart a low-speed high-force drive to said member.

- 5 8. A mechanism as set forth in claim 7 wherein said first piston is mounted for sealed sliding movement within a first cylinder.
9. A mechanism as set forth in claim 8 wherein said first piston is mounted for axial movement relative to said first cylinder.
- 10 10. A mechanism as set forth in claim 9 wherein said first piston and said first cylinder act as said axial force reaction bearing.
11. A mechanism as set forth in claim 8 wherein said second piston is mounted for sealed sliding movement within a second cylinder.
12. A mechanism as set forth in claim 7, and further comprising:
an engaging device for selectively coupling said second transmission mechanism
15 to said output member at any position of said output member.
13. A servoactuator for selectively controlling the movement of an output member in two directions relative to a frame in response to a command signal, comprising:
an electric motor having an output shaft;
a motor controller arranged to provide a drive current to said motor for controllably moving said output shaft;
20 a first transmission mechanism operatively arranged to displace said output member in either direction at a nominal first ratio with respect to said motor output shaft;
a hydrostatic second transmission mechanism operatively arranged to displace said output member in either direction at a nominal second ratio with respect to said
25 motor output shaft; and

a transfer mechanism operatively arranged to selectively couple said motor output shaft to said output member either through said first transmission mechanism to impart a high-speed low-force drive to said output member, or through said second transmission mechanism to impart a low-speed high-force drive to said output member.

- 5 14. A mechanism as set forth in claim 13, and further comprising:
 at least one feedback transducer capable of measuring one of the force, displacement or velocity of said output member; and
 a servo control loop closed about said motor, controller, transmission mechanisms, transfer mechanism, feedback transducer and output member for selectively
10 controlling at least one of the position, velocity or force of said output member as a function of said command signal.
15. A mechanism as set forth in claim 13, and further comprising:
 an engaging device for selectively coupling said second transmission mechanism to said output member at any position of said output member.
- 15 16. A mechanism as set forth in claim 13 wherein said first transmission mechanism is hydrostatic.
17. A mechanism as set forth in claim 16 wherein said first transmission mechanism includes a pump driven by said motor and a first piston coupled to said output member.
18. A mechanism as set forth in claim 17 and further comprising a second piston
20 coupled to said output member, and a plurality of valve components operatively arranged to selectively couple the flow output of said pump to said second piston.
19. A mechanism as set forth in claim 13 wherein said first transmission mechanism includes a screw thread and nut.
20. A mechanism as set forth in claim 19 wherein said first piston is arranged in

series between said nut and one of said output member and frame.

21. A mechanism as set forth in claim 19 wherein said screw has a screw reaction bearing and wherein said first piston is arranged in series between said screw reaction bearing and one of said output member and frame.

- 5 22. A mechanism as set forth in claim 18 wherein said transfer mechanism comprises a plurality of valves operatively arranged to selectively either (a) lock said nut to said output member and allow said second transmission mechanism to be decoupled from said output member, or (b) couple motion of said nut relative to said output member through said second transmission mechanism to said output member.